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### A synthetic biology approach for the development of recombinant protein-based polymers exhibiting antimicrobial properties

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The search for advanced materials, especially for those bioinspired, has recently been the focus of great research in many fields of application. Due to recent advances in materials characterization and fabrication technologies, and especially through the use of synthetic biology approaches, it is now possible to reengineer novel functionalities and structures of protein-based materials, taking advantage of their extreme versatility and applicability.

Antimicrobial peptides (AMPs) are small molecules that occur as part of the innate defense mechanism in many organisms, even in microbes and virus. The combination of AMPs with recombinant protein-based polymers can be explored for the development of advanced medical devices, to overcome infections and biofilm formation. In this work, we describe the design, biological production and processing of a protein-based-polymer comprising a functional domain based on a synthetic cationic AMP, fused in frame with an elastin-like-polymer consisting of 200 repeats of VPAVG (A200), as structural unit. The functionalized protein-based-polymer was produced in *Escherichia coli* and further purified by exploring the thermoresponsiveness property of poly-VPAVG.

Free standing films, especially thinking in downstream processing for application as thin film coating of medical devices, were obtained by solvent-cast. The antibacterial and antifungal activities of cast films were tested against different bacterial and fungal species, both in vitro and ex vivo. The recombinant AMP:A200 biopolymer showed high growth inhibition against a wide range of bacterial species, both gram positive and negative, and yeast species. The antimicrobial activity was time dependent of exposition and remarkably, in some bacterial species, almost 100% of cell death was detected after 30 minutes of cell suspension in contact with cast films.

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